

Claims

1. An ion generator comprising:
a first electrode;
5 a second electrode;
a voltage generator electrically coupled to the first electrode and the second electrode in order, when energized, to create a flow of air in a downstream direction from the first electrode to the second electrode;
a focus electrode located upstream of the first electrode in order to focus the flow
10 of air toward the second electrode.
2. The generator of claim 1 wherein said focus electrode is substantially less emissive of ions than the first electrode.
- 15 3. The generator of claim 1 wherein said focus electrode includes a shape selected from one of a group consisting of rod shaped, wire shaped, planar shaped, concave shaped, and convex shaped.
4. The generator of claim 1 wherein said focus electrode is electrically connected to the
20 first electrode.
5. The generator of claim 1 wherein said focus electrode is in-line and symmetrically aligned with the first electrode and the second electrode.
- 25 6. The generator of claim 1 including two second electrodes and wherein the focus

electrode is in-line with the first electrode and symmetrically aligned with the first and the two second electrodes.

7. The generator of claim 1 wherein the first electrode has a first diameter and the focus electrode has a second diameter and wherein said second diameter of the focus electrode is at least fifteen times larger than the first diameter of the first electrode.

8. The generator of claim 1 wherein said focus electrode is a curved surface.

9. The generator of claim 1 wherein said focus electrode is a curved surface having a plurality of perforations.

10. The generator of claim 1 including a plurality of first electrodes, a plurality of second electrodes, and a plurality of focus electrodes, wherein said focus electrodes are fanned-out.

11. The generator of claim 1 including a plurality of focus electrodes that are fanned-out.

12. The generator of claim 1 including a plurality of focus electrodes.

13. The generator of claim 1 including a plurality of first electrodes and a plurality of pairs of focus electrodes, each pair of focus electrodes associated with at least one of the plurality of first electrodes.

14. The generator of claim 1 including a pair of focus electrodes associated with the first electrode.

15. The generator of claim 1 including a pair of focus electrodes in-line and symmetrically aligned with the first electrode and the second electrode.

16. The generator of claim 1 including two second electrodes and a pair of focus electrodes, and wherein the pair of focus electrode are in-line with the first electrode and symmetrically aligned with the first and the two second electrodes.

17. The generator of claim 1 wherein said focus electrode has a diameter and is upstream from the first electrode a distance of about four or five diameters of the focus electrode.

18. The generator of claim 1 wherein said focus electrode is concave in a direction facing the first electrode.

19. The generator of claim 1 wherein said focus electrode is convex in a direction facing the first electrode.

20. The generator of claim 1 wherein said first electrode is an ion emitter and the second electrode is a collector of particulate matter.

21. The generator of claim 1 wherein said first electrode is positively charged and the second electrode is negatively charged.

22. The generator of claim 1 wherein said focus electrode is a concave disk facing in the direction of the first electrode.

23. The generator of claim 1 wherein said focus electrode is a perforated concave disk facing in the direction of the first electrode.

24. The generator of claim 22 wherein said first electrode is pin-shaped.

25. The generator of claim 23 wherein said first electrode is pin-shaped.

26. The generator of claim 1 including a plurality of focus electrodes forming a "V" shape.

27. The generator of claim 1 wherein said first electrode has a substantially smaller diameter than a diameter of said focus electrode so that said first electrode is substantially more emissive of ions than said focus electrode.

28. An ion generator comprising:
a first electrode;
a second electrode;
a voltage generator electrically coupled to the first electrode and the second electrode in order, when energized, to create a flow of air in a downstream direction from the first electrode to the second electrode;
means located upstream of the first electrode for focusing the flow of air toward the second electrode.

29. The generator of claim 28 wherein said focusing means is substantially less emissive of ions than the first electrode.

30. The generator of claim 28 wherein said focusing means includes a shape selected form one of a group consisting of rod shaped, wire shaped, planar shaped, concave shaped, and convex shaped.

5 31. The generator of claim 28 wherein said focusing means is electrically connected to the first electrode.

10 32. The generator of claim 28 wherein said focusing means is in-line and symmetrically aligned with the first electrode and the second electrode.

33. The generator of claim 28 including two second electrodes and wherein the focusing means is in-line with the first electrode and symmetrically aligned with the first and the two second electrodes.

15 34. The generator of claim 28 wherein the first electrode has a first diameter and the focusing means has a second diameter and wherein said second diameter of the focusing means is at least fifteen times larger than the first diameter of the first electrode.

20 35. The generator of claim 28 wherein said focusing means has a curved surface.

36. The generator of claim 28 wherein said focusing means has a curved surface having a plurality of perforations.

25 37. The generator of claim 28 including a plurality of first electrodes, a plurality of second electrodes, and wherein said focusing means is fanned out relative to said plurality of first

electrodes.

38. The generator of claim 28 wherein said focusing means is fanned out.

5 39. The generator of claim 28 wherein said focusing means has a diameter and is upstream from the first electrode a distance of about four or five diameters of the focusing means.

40. The generator of claim 28 wherein said focusing means is concave in a direction
10 facing the first electrode.

41. The generator of claim 28 wherein said focusing means is convex in a direction facing the first electrode.

15 42. The generator of claim 28 wherein said first electrode is an ion emitter and the second electrode is a collector of particulate matter.

43. The generator of claim 28 wherein said first electrode is positively charged and the second electrode is negatively charged.
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44. The generator of claim 28 wherein said focusing means is a concave disk facing in the direction of the first electrode.

45. The generator of claim 28 wherein said focusing means is a perforated concave disk
25 facing in the direction of the first electrode.

46. The generator of claim 28 wherein said focusing means is “V” shaped.

47. The generator of claim 28 wherein said first electrode has a substantially smaller diameter than a diameter of said focusing means so that said first electrode is substantially more emissive of ions than said focusing means.

48. A device that transports and conditions air including
a housing with an air inlet and an air outlet
a first electrode;
a second electrode;
said first electrode located closer to said air inlet than said second electrode;
said second electrode located closer to said air outlet than said first electrode;
a potential generator electrically coupled to the first electrode and the second electrode in order, when energized, to create a flow of air in a downstream direction from the first electrode to the second electrode; and
a focus electrode located upstream of the first electrode in order to focus the flow of air toward the second electrode.

49. A device that transports and conditions air including
a housing with an air inlet and an air outlet
a first electrode;
a second electrode;
said first electrode located closer to said air inlet than said second electrode;
said second electrode located closer to said air outlet than said first electrode;
a potential generator electrically coupled to the first electrode and the second

electrode in order, when energized, to create a flow of air in a downstream direction from the first electrode to the second electrode; and

a means located upstream of the first electrode for focusing the flow of air toward the second electrode.

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50. A method for transporting and conditioning air comprising the steps of:

generating an electrical potential between a first electrode and a second electrode in order to create a flow of air in a downstream direction from the first electrode to the second electrode and to ionize particulate matter in the air flow; and

10 focusing the flow of air toward said second electrode from a position upstream of said first electrode.

51. The generator of claim 1 wherein when said voltage generator is energized, ions are generated at said first electrode and directed toward said second electrode.

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52. The generator of claim 28 wherein when said voltage generator is energized, ions are generated at said first electrode and directed toward said second electrode.

53. The device of claim 48 wherein when said potential generator is energized, ions are
20 generated at said first electrode and directed toward said second electrode.

54. The device of claim 49 wherein when said potential generator is energized, ions are generated at said first electrode and directed toward said second electrode.

25 55. The method of claim 50 including generating ions with the generation of the electrical

potential.

56. The method of claim 50 including generating ozone with the generation of the electrical potential.

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57. The generator of claim 1 wherein said focus electrode and said first electrode operate at about the same potentials.

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58. The generator of claim 1 wherein said focus electrode and said first electrode operate at positive potentials.

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59. An electro-kinetic air transporter-conditioner, comprising:
a housing having an inlet and an outlet;
a first electrode;
a removable second electrode downstream from the first electrode;
a third electrode upstream of said first electrode;
a voltage generator coupled with the first electrode and the second electrode, said voltage generator, when energized, causing air to flow downstream from said first electrode to said second electrode.

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60. The air transporter-conditioner of claim 59 wherein:
said third electrode is a focus electrode.

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61. The ion generator of claim 1 wherein said second electrode is removable by a user for cleaning.

62. The ion generator of claim 28 wherein said second electrode is removable by a user for cleaning.

63. The device of claim 48 wherein said second electrode is removable by a user for
5 cleaning.

64. The device of claim 49 wherein said second electrode is removable by a user for
cleaning.

10 65. The generator of claim 1 wherein said generator is incorporated in a housing and with
said housing comprises an electro-kinetic air transporter-conditioner.

66. The generator of claim 28 wherein said generator is incorporated in a housing and
with said housing comprises an electro-kinetic air transporter-conditioner.

15 67. The generator of claim 1 wherein said generator is incorporated in a housing and
with said housing comprises an electro-kinetic air transporter-conditioner and said housing
has a top and said second electrode is removable from said top for cleaning.

20 68. The generator of claim 1 wherein:
said generator is incorporated in an elongated freestanding housing with a top and
with said housing comprises an electro-kinetic air transporter-conditioner; and
wherein said second electrode is elongated and is removable from said top of said
housing.

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69. The generator of claim 1 wherein:

said generator is incorporated in an elongated freestanding housing with a top and
with said housing comprises an electro-kinetic air transporter-conditioner; and

5 wherein said second electrode is elongated and is at least partially removable from
said top of said housing.

70. The generator of claim 1 wherein:

said generator is incorporated in an elongated freestanding housing with a top and
with said housing comprises an electro-kinetic air transporter-conditioner; and

10 wherein said second electrode is elongated and is telescopingly removable through
said top of said housing.

71. The generator of claim 28 wherein said generator is incorporated in a housing and
with said housing comprises an electro-kinetic air transporter-conditioner and said housing

15 has a top and said second electrode is removable from said top for cleaning.

72. The generator of claim 28 wherein:

said generator is incorporated in an elongated freestanding housing with a top and
with said housing comprises an electro-kinetic air transporter-conditioner; and

20 wherein said second electrode is elongated and is removable from said top of said
housing.

73. The generator of claim 28 wherein:

said generator is incorporated in an elongated freestanding housing with a top and
25 with said housing comprises an electro-kinetic air transporter-conditioner; and

wherein said second electrode is elongated and is at least partially removable from said top of said housing.

74. The generator of claim 28 wherein:

5 said generator is incorporated in an elongated freestanding housing with a top and with said housing comprises an electro-kinetic air transporter-conditioner; and wherein said second electrode is elongated and is telescopingly removable through said top of said housing.

10 75. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising:

a first electrode;
a second electrode downstream of the first electrode;
a focus electrode upstream of the first electrode; and
15 a voltage generator electrically coupled with the first and second electrode.

76. The generator as recited in claim 75, wherein the first electrode has at least one electrode that has at least one characteristic from a group consisting of (i) a rod-shaped wire, (ii) a spiral coil wire, (iii) a curved wire, (iv) a flat spiral wire, (v) slack wire and (vi) a
20 tapered pin-shaped electrode.

77. The generator as recited in claim 75, wherein the second electrode has at least two electrodes having at least one characteristic from a group consisting of (i) a U-shaped cross-section, (ii) an L-shaped cross-section, and (iii) a ring-shaped.

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78. The generator as recited in claim 75, wherein the focus electrode is in-line and symmetrically aligned with the first electrode.

5 79. The generator as recited in claim 77, wherein the second electrode has a U-shaped cross-section and a protective end formed with said second electrode.

10 80. The generator as recited in claim 75, wherein the focus electrode has at least one characteristic from a group consisting of (i) a rod-shaped wire, (ii) a convex surface, and a (iii) concave surface.

81. The generator as recited in claim 75, wherein the focus electrode is substantially non-emissive in comparison to the first electrode.

15 82. The generator as recited in claim 75, wherein the diameter of the focus electrode is fifteen times greater than the diameter of the first electrode.

83. The generator as recited in claim 75, wherein the focus electrode and the first electrode are electrically connected.

20 84. The generator as recited in claim 75, wherein the ion generator further has a trailing electrode located downstream of the second electrode.

85. The ion generator as recited in claim 84, wherein the voltage generator is further electrically connected to the trailing electrode.

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86. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising:

a first electrode;

5 a second array of electrodes downstream of said first electrode, said second array having at least two electrodes, said electrodes having a protective end formed therewith;

a focus electrode upstream to said first electrode; and

10 a voltage generator electrically coupled with said first electrode and said second array.

87. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising:

a first array of electrodes, said first array having at least two electrodes;

15 a second array of electrodes located downstream of said first array, said second array having at least three electrodes, said second electrodes having a protective end formed therewith;

a focus electrode located upstream of each said electrode in said first array;

and

20 a voltage generator electrically coupled with the first and second array.

88. An electro-kinetic air transporter-conditioner, comprising:

a housing having an inlet and outlet; and

an ion generator disposed within the housing, said ion generator for creating an airflow between said inlet and said outlet, including:

25 a first array of electrodes;

a second array of electrodes located downstream of said first array of electrodes;

an array of focus electrodes located upstream to said first array of electrodes; and

5 a voltage generator electrically coupled with said first and second array of electrodes.

89. An electro-kinetic air transporter-conditioner for removing particles from the air, comprising:

10 a housing having an inlet and an outlet; and

an ion generator disposed within said housing, said ion generator for creating an airflow between said inlet and said outlet, including:

a first electrode;

a second electrode downstream of said first electrode;

15 a voltage generator electrically coupled with said first and second electrode; and

means for urging the particles towards the second electrode, which means is located upstream of the first electrode.

20 90. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising:

a first array of electrodes;

a second array of electrodes located downstream of said first array of electrodes, said second array of electrodes including at least two electrodes, each said

25 electrode having a nose, a first trailing side and a second trailing side, said first and second

trailing sides having a protective end formed therewith;

an array of leading electrodes located upstream of said first array of electrodes; and

a voltage generator coupled with said first and second array of electrodes.

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91. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising;

a first array of electrodes;

10 a second array of electrodes located downstream of said first array of electrodes;

an array of focus electrodes located upstream to said first array of electrodes;

a voltage generator coupled with said first and second array of electrodes;

and

15 an array of trailing electrodes located downstream of said second array of electrodes.

92. The generator as recited in claim 91, wherein said array of focus electrodes and said first array of electrodes are electrically connected.

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93. The generator as recited in claim 91, wherein said array of trailing electrodes and said second array of electrodes are electrically connected.

94. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising:

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a first array of electrodes;

a second array of electrodes located downstream of said first array of electrodes;

5 a first array of leading electrodes located upstream to said first array of electrodes;

a second array of leading electrodes located upstream of said first array of leading electrodes;

10 a voltage generator coupled with said first array of electrodes, said second array of electrodes, and said first array of leading electrodes.

95. An electro-kinetic air transporter-conditioner having an ion generator, the ion generator comprising:

a first array of electrodes;

15 a second array of electrodes located downstream of the first array of electrodes;

an array of leading electrodes located upstream of said first array of electrodes;

a voltage generator coupled with said first array of electrodes, said second array of electrodes, and said array of leading electrodes; and

20 an interstitial electrode located midway between each electrode within said second array of electrodes.

96. The generator as recited in claim 95, wherein the first electrodes and the leading electrodes are electrically connected.

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97. The generator as recited in claim 95, wherein the interstitial electrode and the second electrodes are electrically connected.

98. An electro-kinetic air conditioner-transporter, comprising:

5 a housing with an inlet and an outlet; and
an ion generator disposed within said housing, said ion generator for creating an airflow between said inlet and said outlet, including:

a first array of electrodes;

10 a second array of electrodes located downstream of said first array
of electrodes;

an array of leading electrodes located upstream of said first array of electrodes, said array of leading electrodes each having a "U"-shaped cross-section and a perforated surface; and

15 a voltage generator electrically coupled with said first array of
electrodes, said second array of electrodes, and said array of leading electrodes.

99. The electro-kinetic air conditioner-transporter as recited in claim 98, wherein said first array of electrodes has at least one electrode that shares at least one characteristic from a group consisting of (i) a rod-shaped wire, (ii) a spiral coil wire, (iii) a curved wire, (iv) a flat spiral wire, (v) slack wire, and (vi) a tapered pin-shaped electrode.

100. The electro-kinetic air conditioner-transporter as recited in claim 98, wherein said second array of electrodes has at least two electrodes sharing at least one characteristic from a group consisting of (i) a U-shaped cross-section, (ii) an L-shaped cross-section, and (iii)
25 a ring-shaped.

101. An electro-kinetic air conditioner-transporter for removing particles within the air, comprising:

a housing with an inlet and an outlet; and

an ion generator disposed within said housing, said ion generator can create

5 an airflow between said inlet and said outlet, including:

at least a first electrode, said first electrode generating an electric field for charging the particles within the airflow;

10 a second array of electrodes having at least two second electrodes, said second electrodes located downstream of said first electrode, each said second electrode having an electrical charge opposite of said first electrode, and said second array of second electrodes attracting the particles within the airflow;

a leading electrode, said leading electrode located upstream of said first electrode, said leading electrode having the same electrical charge as said first electrode for shaping the electrical field generated by said first electrode; and

15 a voltage generator electrically coupled with said first electrode, said second array of electrodes, and said leading electrode.

102. An electro-kinetic air conditioner-transporter for removing particles within the air, comprising:

20 a housing with an inlet and an outlet; and

an ion generator disposed within said housing, said ion generator for creating an airflow between said inlet and said outlet, including:

a first array of electrodes, said first array of electrodes generating an electric field for electrically charging the particles within the airflow;

25 a second array of electrodes, said second array of electrodes located

downstream of said first array of electrodes, said second array of electrodes generating an electrical field opposite to said first array of electrodes so that the electrically charged particles can be attracted to said second array of electrodes;

an array of leading electrodes, said array of leading electrodes
5 located upstream of said first array of electrodes, said array of leading electrodes having the same electrical charge as said first array of electrodes for shaping the electrical field generated by said first array of electrodes; and

a voltage generator electrically coupled with said first array of
10 electrodes, said second array of electrodes, and said array of leading electrodes.

103. An electro-kinetic air conditioner-transporter for removing particles within the air, comprising:

a housing with an inlet and an outlet; and

an ion generator disposed within said housing, said ion generator for creating
15 an airflow between said inlet and said outlet, including:

a first array of electrodes, said first array of electrodes generating an electric field for electrically charging the particles within the airflow;

a second array of electrodes, said second array of electrodes located
20 downstream of said first array of electrodes, said second array of electrodes generating an electrical field opposite to said first array of electrodes so that the electrically charged particles can be attracted to said second array of electrodes;

an array of leading electrodes, said array of leading electrodes located
upstream of said first array of electrodes, said array of leading electrodes having the same
electrical charge as said first array of electrodes for shaping the electrical field generated by
25 said first array of electrodes;

an array of trailing electrodes, said array of trailing electrodes having the same electrical charge as said second array of electrodes; and

a voltage generator electrically coupled with said first array of electrodes, said second array of electrodes, and said array of leading electrodes and said array of trailing electrodes.

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104. The electro-kinetic air conditioner-transporter as recited in claim 29, wherein said array of leading electrodes has at least one electrode sharing at least one characteristic from a group consisting of (i) a U-shaped cross-section, (ii) a circular cross-section, and (iii) a perforated surface.

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105. The electro-kinetic air conditioner-transporter as recited in claim 103, wherein at least one of the trailing electrodes of said array of trailing electrodes are located midway between two said second electrodes of said second array of electrodes.

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106. An electro-kinetic air transporter-conditioner for removing particles from the air, comprising:

a housing having an inlet and an outlet;

an ion generator disposed within said housing, said ion generator for creating

an airflow between said inlet and said outlet, including:

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a first array of electrodes;

a second array of electrodes located downstream of the first array of electrodes;

an array of leading electrodes located upstream of said first array of electrodes;

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an array of trailing electrodes; and

a voltage generator coupled with said first array of electrodes, said second array of electrodes, and said array of leading electrodes.

5 107. An electro-kinetic air transporter-conditioner as recited in claim 106, wherein said array of trailing electrodes are located downstream of said second array of electrodes.

108. An electro-kinetic air transporter-conditioner as recited in claim 106, wherein said high voltage generator is further electrically coupled with said array of trailing electrodes.

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109. An electro-kinetic air transporter-conditioner as recited in claim 108, wherein each said trailing electrode within said array of trailing electrodes is located midway between two said second electrodes of said second array of second electrodes.

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110. An electro-kinetic air transporter-conditioner as recited in claim 106, wherein the diameter of each electrode within said array of leading electrodes is fifteen times greater than the diameter of each electrode within said first array of electrodes.

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111. An electro-kinetic air transporter-conditioner as recited in claim 109, wherein each electrode within said array of trailing electrodes repels the particles within the airflow towards each second electrode within said second array of electrodes.

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112. The air transporter-conditioner of claim 59 wherein said housing has a top and the second electrode is removable from said top for cleaning.